is set to be larger than the magnitude of the magnetic moment of the first pinned magnetic layer **103** to align the magnetization direction of the pinned magnetic layer P_1 in the Y direction. On the other hand, the magnitude of the magnetic moment of the third pinned magnetic layer **109** pinned in the Y direction is set to be smaller than the magnitude of the magnetic moment of the fourth pinned magnetic layer **111** to align the magnetization direction of the pinned magnetic layer P_2 to be antiparallel to the Y direction.

[**0362**] In this arrangement, the direction of the magnetic field, which is created when the sense current flows in the X direction, coincides with the magnetization direction of the pinned magnetic layer P_1 and the magnetization direction of the pinned magnetic layer P_2. This arrangement stabilizes the ferrimagnetic state of the first pinned magnetic layer **103** and the second pinned magnetic layer **101** and the ferrimagnetic state of the third pinned magnetic layer **109** and the fourth pinned magnetic layer **111**.

[**0363**] The first free magnetic layer **105** and the second free magnetic layer **107** are designed to have different magnetic moments. Here again, the first free magnetic layer **105** and the second free magnetic layer **107** are manufactured of the same material with thicknesses thereof made different so that the two layers have different magnetic moments.

[**0364**] The nonmagnetic material layers **102, 106**, and **116** are made of a material selected from the group consisting of Ru, Rh, Ir, Cr, Re, Cu, and alloys thereof.

[**0365**] Referring to **FIG. 13**, the first free magnetic layer **105** and the second free magnetic layer **107** are laminated with the nonmagnetic layer **106** interposed therebetween, and function as a single free magnetic layer F.

[**0366**] The first free magnetic layer **105** and the second free magnetic layer **107**, which are in a ferrimagnetic state with the magnetization directions thereof being antiparallel, namely different from each other by 180 degrees, achieve the same effect, which can be provided by the use of a thin free magnetic layer F. This arrangement reduces the saturation magnetization of the entire free magnetic layer F, causing the magnetization of the free magnetic layer F to easily vary, and thereby improving the magnetic field detection sensitivity of the magnetoresistive-effect device.

[**0367**] The direction of the sum of the magnetic moments of the first free magnetic layer **105** and the second free magnetic layer **107** becomes the magnetization direction of the free magnetic layer F.

[**0368**] The hard bias layers **114** and **114** are magnetized in the X direction (i.e., the direction of the track width), and the magnetization direction of the free magnetic layer F is aligned in the X direction under the bias magnetic field in the X direction given by the hard bias layers **114** and **114**.

[**0369**] The two end portions of the free magnetic layer F, having disturbed magnetization directions, present a poor reproduction gain, and become insensitive regions unable to exhibit no substantial magnetoresistive effect.

[**0370**] In the thirteenth embodiment again, the sensitive region E and the insensitive regions D and D of the multilayer film **203** are measured using the micro track profile method. Referring to **FIG. 13**, the portion, having the width dimension **T52**, centrally positioned in the multilayer film **203** is the sensitive region E, and the portions, each having the width dimension **T53**, on both sides of the sensitive region E are the insensitive regions D and D.

[**0371**] In the sensitive region E, the magnetization directions of the pinned magnetic layers P_1 and P_2 are correctly aligned in a direction parallel to the Y direction, and the magnetization of the free magnetic layer F is correctly aligned in the X direction. The pinned magnetic layers P_1 and P_2 and the free magnetic layer F are perpendicular to each other in magnetization direction. The magnetization of the free magnetic layer F varies sensitively in response to an external magnetic field from the recording medium. An electrical resistance varies in accordance with the relationship between the variation in the magnetization direction of the free magnetic layer F and the pinned magnetic field of the pinned magnetic layers P_1 and P_2. A leakage magnetic field from the recording medium is thus detected in response to a variation in voltage due to the electrical resistance variation. However, those which directly contribute to the variation in the electrical resistance (i.e., the reproduction output) are a relative angle made between the magnetization direction of the first pinned magnetic layer **103** and the magnetization direction of the first free magnetic layer **105**, and a relative angle made between the magnetization direction of the third pinned magnetic layer **109** and the magnetization direction of the second free magnetic layer **107**. These magnetization directions are preferably perpendicular with a sense current conducted in the absence of a signal magnetic field.

[**0372**] Referring to **FIG. 13**, in this invention, electrode layers **116** and **116** are respectively formed on top of intermediate layers **115** and **115**, which in turn are respectively formed on top of the hard bias layers **114** and **114** on both sides of the multilayer film **203**. The electrode layers **116** and **116** extend over the insensitive regions D and D of the multilayer film **203**. The electrode layers **116** and **116** are made of a Cr, Au, Ta, or W film.

[**0373**] The width dimension of the top surface of the multilayer film **203** not covered with the electrode layers **116** and **116** is defined as the optical read track width O-Tw. The width dimension **T52** of the sensitive region E not covered with the electrode layers **116** and **116** is defined as the magnetic read track width M-Tw. In the thirteenth embodiment, the electrode layers **116** and **116** extending over the multilayer film **203** fully cover the insensitive regions D and D. The optical read track width O-Tw is thus approximately equal to the magnetic read track width M-Tw (i.e., the width dimension of the sensitive region E).

[**0374**] It is not a requirement that the electrode layers **116** and **116** formed above the multilayer film **203** fully cover the insensitive regions D and D, and the width dimension **T54** of each of the electrode layers **116** and **116** may be narrower than the insensitive region D. In this case, the optical read track width O-Tw becomes larger than the magnetic read track width M-Tw.

[**0375**] This arrangement makes it easier for the sense current to directly flow from the electrode layers **116** and **116** into the multilayer film **203** without passing through the hard bias layers **114** and **114**. With the electrode layers **116** and **116** respectively extending over the insensitive regions D and D, the junction area between the multilayer film **203** and